REMARKS

This paper is responsive to the Office Action of December 4, 2002 and the Advisory Action dated February 14, 2003. It is believed that the reply raises no new issues, does not require an additional search and/or places the application in a better condition for allowance and/or appeal.

In particular, claim 1 has been amended to replace "high-K material" with "a material having a relative permittivity of greater than 10." This change is consistent with the express definition of "high-K material" provided in the present application at page 4, lines 18-24 and, therefore, does not change the scope of claim 1. In addition, claim 20 has been placed in independent form. **Accordingly, entry of the reply is considered proper.**

Reexamination and reconsideration of the application are respectfully requested.

The Office Action

Claims 1-4, 8, 9 and 20 stand rejected under 35 U.S.C. §102(b) as being anticipated by Wilting (U.S. Pat. No. 4,080,719).

Claims 1-5, 8, 9 and 20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Grant et al. (U.S. Pat. No. 6,423,619) in view of Wilting.

Claims 6 and 7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Grant in view of Wilting and further in view of Raajimakers et al. (U.S. Pat. Application Pub. No. US 2001/0031562A1).

Claim 10 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Wilting in view of Venkatesan et al. (U.S. Pat. No. 5,736,435).

Claim 10 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Grant in view of Wilting and further in view of Venkatesan et al.

The Present Claims Distinguish Patentably
Over the References of Record

Claim 1 calls for a semiconductor device, which includes a source and a drain, where the source and the drain **consist essentially of silicide**, and a gate dielectric made from a **material having a relative permittivity of greater than about 10.**

With regard to the language "consisting essentially of", the Examiner's attention is directed to MPEP 2111.03, which states, "the transitional phrase 'consisting essentially of' limits the scope of a claim to the specified materials or steps 'and those that do not materially affect the basic and novel characteristic(s)' of the claimed invention." *In re Herz*, 537 F.2d 549, 551-52, 190 USPQ 461, 463 (CCPA 1976) (emphasis in original).

Wilting fails to disclose or fairly suggest a semiconductor device, which includes a gate dielectric made from a material having a relative permittivity of greater than 10. Paragraph 5 of the Office action states that, "there is a gate dielectric (4A, 4B), made from silicon oxide (4A) and silicon nitride (4B), which separates the gate electrode (16A) and the body."

At the outset, applicants note that neither silicon oxide nor silicon nitride, standing alone as a single layer or formed together as stacked layers, constitute a gate dielectric made from a material having a relative permittivity greater than 10. In particular, silicon oxide has a K of approximately 3.9 (see, for example, page 5, lines 16-17 of the present application and Grant at col. 1, line 15), while silicon nitride has a K of approximately 6-9 (see, for example, page 5, lines 6-7 of the present application).

Further, the Office action's reliance on Lee for a showing that silicon oxide and silicon nitride (as used and disclosed by Wilting) are high-K materials is improper. First, at col. 5, lines 30-31, Lee does not discuss silicon oxide or silicon nitride. Rather, Lee discusses a "NO (Nitride-Oxide)" layer, which is not a conventional chemical expression and, at best, can be interpreted as silicon oxynitride, having a K of about 4-8. Second, even if Lee referred to one or both of silicon nitride and silicon oxide as "high-K materials,"

this charact rization is irrelevant in light of applicants' cl ar enumeration of the m aning of the claim term within the specification of the application.

In addition, Wilting fails to disclose or fairly suggest a semiconductor device, which includes a source and a drain consisting essentially of silicide. Paragraph 5 of the Office action points to col. 7, lines 46-47 of Wilting, alleging that Wilting "discloses that the source and drain regions (31, 32) are entirely silicide." However, applicants respectfully submit that this language is taken out of context. In particular, the description found at col. 7, lines 46-55 of Wilting describes Figure 16, which illustrates silicide drain zones (31) and (32) within p-type drain zones (41) and (42) (designated by dashed lines in Figures 14-16).

More particularly, Figures 14-16 of Wilting, along with the associated description in column 7, clearly differentiate between the source and drain zones (41) and (42) and source and source and drain zones (31) and (32). P-type source and drain zones (41) and (42) are formed by "indiffusion or implantation." (see, for example, col. 7, lines 49-50). For these reasons alone, claim 1 is neither anticipated nor rendered obvious by Wilting.

In addition, "a patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified." MPEP 2141.02, *citing, In re Sponnoble*, 160 U.S.P.Q. 237, 243 (CCPA 1969). Applicants acknowledge that those who allege discovery of the source of a problem and solution must provide substantiating evidence. MPEP 2141.02.

In this case, applicants, at the time of the invention, discovered that a need exists for a semiconductor device having a stable, quality high-K dielectric layer that is not compromised (i.e., the thermal budget is not exceeded, causing the material becoming unstable, to lose its electrical characteristics, and/or to react undesirably with other materials in the device) due to thermal processing associated with anneal cycles following source and drain ion implantation.

Evidence of the discovery of the source or cause of this problem, i.e., instability of high-K materials when a thermal budget for the high-K material is exceeded (e.g., following

anneal cycles to activate dopant species forming the source and/or drain), can be found in Applicant's Patent Application at page 10, lines 17-29.

Further, in response to the discovered problem, applicants developed a solution to the problem. A semiconductor device was created that includes a quality high-K dielectric layer, which is not compromised by additional thermal processing required by high temperature anneal cycles following ion implantation. Rather, a device having a source and a drain consisting essentially of silicide is formed with low temperature processing (e.g., about 350°C to about 450°C) and without conventional ion implantation. These limitations, which solve the discovered problem, are present in claim 1 and distinguish the invention patentably over the references of record.

With regard to the alternate rejection of claim 1 (i.e., Grant in view of Wilting), both Grant (see, for example, col. 2, lines 41-44) and Wilting (see above discussion) teach sources and drains formed using conventional ion implantation. This ion implantation must be coupled with relatively high temperature processing (e.g., about 1000°C, as disclosed in Wilting), which is prone to damage an associated high-K gate dielectric layer. In contrast, the present invention discovered the source of a problem involving the thermal budget of high-K gate dielectric materials and provided a solution (i.e., a device having a silicide source and drain formed without ion implantation).

The other cited references, including Raajimakers et al. and Venkatesan et al., fail to cure the deficiencies of both Wilting and Grant. Accordingly, it is submitted that **claim 1 and claims 2-10**, dependent therefrom, distinguish patentably over the references of record. In addition, the dependent claims recite additional novel and unobvious features of the invention.

Claim 20, which has been placed in independent form, calls for a semiconductor device including a source and a drain **consisting essentially of silicide** and a semiconductor body disposed between the source and the drain, wherein a **source/body junction is defined by silicid material of th source and semiconductor material of**

th body and a drain/body junction is defined by silicide material f th drain and miconductor of the body.

None of the cited references, taken alone or in combination, disclose or fairly suggest source/body and drain/body junctions defined by silicide material of the source/drain and semiconductor material of the body.

In this regard, applicants respectfully submit that what is alleged in paragraphs 9 and 16 of the Office action is simply inaccurate. In particular, both of paragraphs 9 and 16 of the Office action point to Figure 16 of Wilting for the teaching of source/body and drain/body junctions defined by silicide material of the source/drain and semiconductor material of the body. However, **Figure 16 of Wilting, along with the associated description at column 7, clearly shows silicide source zone (31) within implanted p-type source zone (41) (shown by dashed line) and silicide drain zone (32) within implanted p-type drain zone (42) (shown by dashed line).** As such, the source/body junction of the device disclosed in Wilting is defined by the p-type semiconductor material of source zone (41) and the semiconductor material of the body. Similarly, the drain/body junction of the Wilting device is defined by the p-type semiconductor material of drain zone (42) and the semiconductor material of the body. Grant, along with the other cited references, fails to cure the deficiencies of Wilting.

Accordingly, it is submitted that **claim 20** distinguishes patentably over the references of record.

Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. §102(b) and §103(a) is requested.

Conclusion

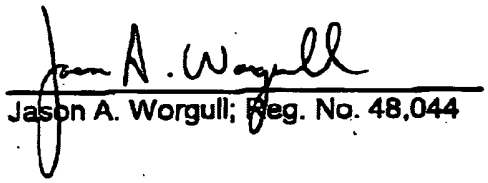
In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested.

If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any fees resulting from this communication, please charge same to our Deposit Account No. 18-0988, our Order No. G0615.

Respectfully submitted,

RENNER, OTTO, BOISSELLE & SKLAR, LLP

By 
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APPENDIX A
SUPPLEMENTAL REPLY UNDER 37 C.F.R. 1.116
TO OFFICE ACTION DATED DECEMBER 4, 2002

Applicant:	Bin Yu, et al
Serial No.:	10/044,493
Filed:	January 11, 2002
Title:	SEMICONDUCTOR DEVICE WITH SILICIDE SOURCE/DRAIN AND HIGH-K DIELECTRIC
Examiner:	Kevin V. Quinto
Docket No.:	G0615

Art Unit: 2826
Confirmation No.: 9266

A marked version of the amended claims appears below (deletions bracketed and struck through and additions underlined):

1. (twice amended) A semiconductor device comprising:

a source and a drain, said source and drain consisting essentially of silicide;

a semiconductor body disposed between the source and the drain;

a gate electrode disposed over the body and defining a channel interposed between the source and the drain; and

a gate dielectric [~~made from a high-K material and~~] separating the gate electrode and the body, said gate dielectric being made from a material having a relative permittivity of greater than about 10.

20. (amended) A [~~The~~] semiconductor device [~~according to claim 1,~~] comprising:

a source and a drain, said source and drain consisting essentially of silicide;

a semiconductor body disposed between the source and the drain, wherein a source/body junction is defin d by silicide material of the source and semiconductor

material of the body and a drain/body junction is defined by silicide material of the drain and semiconductor material of the body;

a gate electrode disposed over the body and defining a channel interposed between the source and the drain; and

a gate dielectric separating the gate electrode and the body, said gate dielectric being made from a material having a relative permittivity greater than about 10.

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